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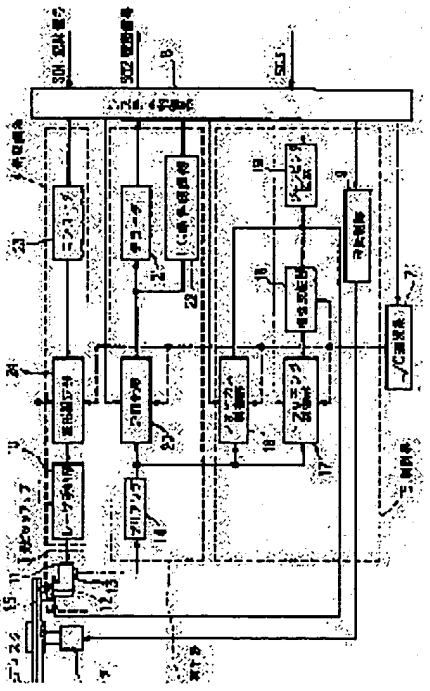
(54) OPTICAL INFORMATION RECORDING MEDIUM AND OPTICAL INFORMATION RECORDING/REPRODUCING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical recording medium minimized in read-out error on both lands and grooves of a guide groove, and its recording/reproducing device.

SOLUTION: This recording/reproducing device is constituted so that the information signal is recorded by photoirradiation on the optical information recording medium furnished with the projected-recessed guide grooves. By means of providing a selection part for selecting which surface of the lands or grooves of the guide groove is tracked, a polarity inverting device 18 of the tracking operated linked with the selection part, and



a recording waveform setting part for setting the condition of photoirradiation simultaneously corresponding to each of the lands and grooves, the difference of the recording characteristics at the time of photoirradiation generated between the grooves and lands is compensated, then the recording of the signal minimized in distortion on both of them is attained.

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* NOTICES *

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CLAIMS

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(57) [Claim(s)]
[Claim 1] Were prepared on the substrate which has the guide slot which consists of a crevice and heights, and said substrate. It is the record medium equipped with the record thin film which produces change which can be optically detected by the exposure of light. The record medium which has an identifier for expressing the record conditions of said crevice of said guide slot in the case of record of a signal being possible to both said crevice of said guide slot, and said heights, and recording information on said crevice and said heights of said guide slot, and each of said heights.
[Claim 2] Said identifier is a record medium including the information which shows the exposure conditions of each light when recording information on said crevice and said heights of said guide slot according to claim 1.
[Claim 3] Said identifier is a record medium including the information which shows the exposure reinforcement of the light about each when recording information on said crevice and said heights of said guide slot according to claim 1.
[Claim 4] Said identifier is a record medium including the information which shows the pulse pattern about each when recording information on said crevice and said heights of said guide slot according to claim 1.
[Claim 5] Said identifier is a record medium including the width of face of said guide slot, the depth, a pitch, and the information showing at least one of surface states according to claim 1.
[Claim 6] Said identifier is a record medium according to claim 1 currently formed in parts other than the information record section on a record medium.
[Claim 7] By irradiating a light beam to the record medium equipped with record film on the guide slot which consists of a crevice and heights It is the optical information record playback approach of performing record playback of a signal to both said crevice of said guide slot, and said heights. The optical information record playback approach containing the step which restores to the identifier which shows the record conditions over each of said crevice and said heights of said guide slot formed on the record medium, and the step which modulates the information signal which should be recorded on the crevice and heights of a record medium based on the result of having restored to said identifier.
[Claim 8] The optical information record playback approach according to claim 7 that the wave of two or more of said pulse trains changes with said record conditions to which it restored including the step which irradiates light which consists of two or more pulse trains to one record mark recorded on a record medium.
[Claim 9] The optical information record playback approach according to claim 7 that the power of the light beam which irradiates on a record medium changes based on said record conditions to which it restored.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] About the optical information record medium which a light beam is used, and information is recorded and can be reproduced, and an optical record regenerative apparatus, this invention is recording a signal on the land of a guide slot, and the both sides of a groove especially, and relates to the optical information record medium and optical record regenerative apparatus which can obtain high track density.
[0002]
[Description of the Prior Art] An optical disk, an optical card, or an optical tape is well-known, using an optical means and using information as the record medium (record member) recorded or reproduced. Information is recorded when the record to these record media usually irradiates the laser beam which the laser beam was used as the light source and was minutely condensed through the lens to the record thin film of a record medium.
[0003] An optical disk consists of fundamentally a circular substrate which equipped the shape of a spiral, and concentric circular with the guide slot which becomes the front face from irregularity, and a record thin film formed on it in these record media. Information is recorded on a record thin film by irradiating the beam by which that reinforcement was modulated according to the information signal along with this guide Mizogami.
[0004] Physical properties of thin film change with the exposures of light to a record thin film, and it is required that the condition difference before and after browning-izing should be optically equipped with the property of being detectable. As change of typical record physical properties of thin film, deformation of the thin film by the absorption of light or the phase change of state of the thin film by optical exposure occurs, and it is known as a deformation record medium and a phase change record medium, respectively. As for the record by change of these physical properties, a signal is reproduced as a difference of the amount of reflected lights.
[0005] Moreover, the magneto-optic-recording medium which reproduces a signal is known by recording information by impressing a magnetic field to an optical exposure and coincidence, and detecting the difference of the magnetization direction of a record thin film using the Kerr effect.
[0006] In order to put these optical record media in practical use according to each application and to increase amount of information recordable on a current pan, examination which raises recording density is performed briskly.
[0007] As one of the approaches of raising the recording density of an optical information record medium, the approach of recording a signal on the both sides of the crevice of a guide slot and heights is proposed to the method which records a signal on either of the crevice of the conventional guide slot, and heights (Japanese Journal of Applied Physics Vol.32 (1993) p.5324-5328).
[0008] It is using the substrate which the approach shown here made width of the crevice of a guide slot, and heights almost equal, and optimized the depth, and has realized carrying out record playback of the information signal to the both sides of a crevice and heights. Henceforth, in this description, the case

where the part of a convex is recorded on a groove, a call, and heights to the incidence side of light is considered as groove record. Moreover, the case where the part by the side of concave is recorded on a land, a call, and a crevice to an incidence side is called land record. If the approach of recording a signal on the both sides of a land and a groove is used, compared with the method recorded only on one side of the conventional guide slot, it is supposed that it is possible to make track density into twice [about].
[0009] Theoretically, since the same optical system as usual and an optical recording system can be used and it only corresponds to the crevice or heights of a guide slot, record playback of the information by this method adds the means which changes the polarity of tracking, and can be realized by irradiating the light beam which carried out intensity modulation to both fields according to the information signal.
[0010]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional technique, when the signal recorded on the record medium was reproduced, the flume problem which differences, such as amplitude and frequency characteristics, produce was in the regenerative signal by the land and the groove. The difference of this signal amplitude changed also with the configurations of a record thin film.
[0011] For this reason, there was a case where many errors occurred in the truck of another side in the process which restores to a regenerative signal even if one truck of a land and a groove is able to perform good signal record.
[0012] Moreover, even if it was the record thin film of the same configuration, also when a configuration, a flute width, etc. of an edge of a guide slot were changed, the difference was produced in the same regenerative signal by both trucks.
[0013] moreover, in order [in the both sides of a land and a groove] to carry out reading appearance and to lessen an error, the optical information record medium had the problem that it was necessary to manufacture with high process tolerance.
[0014] the place which it is made in order that this invention may solve the above-mentioned technical problem, and is made into the object is in the thing in the both sides of the land of a guide slot, and a groove for which reading appearance is carried out and few optical record medium and its record regenerative apparatus of an error are offered.
[0015]
[Means for Solving the Problem] The substrate which has the guide slot where the record medium concerning this invention consists of a crevice and heights, It is the record medium equipped with the record thin film which was prepared on said substrate and which produces change which can be optically detected by the exposure of light. Record of a signal is possible to both said crevice of said guide slot, and said heights, it has an identifier for expressing the record conditions of said crevice of said guide slot in the case of recording information on said crevice and said heights of said guide slot, and each of said heights, and the above-mentioned object is attained by that. Said identifier may also include the information which shows the exposure conditions of each light, when recording information on said crevice and said heights of said guide slot. Said identifier may also include the information which shows the exposure reinforcement of the light about each, when recording information on said crevice and said heights of said guide slot. Said identifier may also include the information which shows the pulse pattern about each, when recording information on said crevice and said heights of said guide slot. Said identifier may also include the width of face of said guide slot, the depth, a pitch, and the information showing at least one of surface states. Said identifier may be formed in parts other than the information record section on a record medium. The optical information record playback approach concerning this invention by irradiating a light beam to the record medium equipped with record film on the guide slot which consists of a crevice and heights It is the optical information record playback approach of performing record playback of a signal to both said crevice of said guide slot, and said heights. The step which restores to the identifier which shows the record conditions over each of said crevice and said heights of said guide slot formed on the record medium, Based on the result of having restored to said identifier, the above-mentioned object is attained by that including the step which modulates the information signal which should be recorded on the crevice and heights of a record

medium. The wave of two or more of said pulse trains may change with said record conditions to which it restored to one record mark recorded on a record medium including the step which irradiates light which consists of two or more pulse trains. Based on said record conditions to which it restored, the power of the light beam which irradiates on a record medium may change. [0016]
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[0034] According to the selection result of a selection means, the operating condition suitable for a crevice and heights is chosen by having the operating condition for at least one of a focal control means, a tracking control means, a wave setting-out means, and these signal regeneration means carrying out record playback of the information signal in the crevice and heights of a guide slot. since this operating condition can be set up according to an individual to a crevice and heights, reading appearance of it is carried out to the both sides of a crevice and heights, and it can perform record playback in optimum conditions with few errors.
[0035] Since the reinforcement of a light beam can be changed by the signal record to a crevice, and signal record of heights when the wave setting-out means is equipped with two or more kinds of modulation patterns as an operating condition, the difference of the temperature rise produced when a light beam is irradiated at the crevice and heights of a guide slot, and cooling conditions can be amended.
[0036] Since offset can be given so that a light beam may condense at accuracy to the both sides of the record thin film of the crevice of a guide slot, and a heights record thin film when the focal control means or the tracking control means is equipped with the operating condition for carrying out record playback of the information signal in the crevice and heights of a guide slot, the light beam optimal at the time of record playback can be irradiated.
[0037] Even when a difference is between the information signal from the record mark recorded on the crevice when the signal regeneration means was equipped with the operating condition for carrying out record playback of the information signal in the crevice and heights of a guide slot, and the information signal from the record mark recorded on heights, the recovery signal from the crevice and heights of a guide slot can be arranged by switching recovery conditions, such as an equalizing characteristic or slice level.
[0038] Moreover, before carrying out record playback of the information signal, in the predetermined field of an optical information record medium, record playback can be beforehand carried out using a reference signal, and the individual difference of an optical information record medium and an optical information record regenerative apparatus can be compensated by setting up the optimal operating condition for the optical information record medium and the optical information record regenerative apparatus which are used.
[0039] Furthermore, the individual difference of an optical information record medium can be

compensated by giving the property identifier beforehand to the optical information record medium.
[0040]
[Embodiment of the Invention] Hereafter, one example of the optical information record medium of this invention and an optical information record regenerative apparatus is explained, referring to a drawing. Drawing 1 is the block diagram showing the configuration of the optical information record regenerative apparatus of this invention. The optical information record regenerative apparatus of this invention serves as the spindle motor 2 made to rotate the optical disk 1 which is the optical information record medium equipped with the guide slot which consists of irregularity, and the optical pickup 3 which condenses the light beam generated from the light sources, such as a laser beam, from the following five circuit systems which control these each part. The 1st is the light modulation system 4 which drives the light source of an optical pickup. The 2nd is the control system 5 which controls actuation of light beams, such as tracking which the light which carried out outgoing radiation from pickup is condensed [tracking] on an optical disk 1, and makes a light beam follow guide Mizogami. The 3rd is the signal regeneration system 6 for reading the information signal formed on the optical disk. at least one of each of the three circuit systems of these is equipped with two or more kinds of conditioning functions so that the land and groove of a guide slot may be alike, respectively, it may receive and the optimal conditions can be set up.
[0041] The 4th is the land / groove selection system 7 (it is henceforth expressed also as an L/G selection system) which switches the three above-mentioned circuit conditions according to any [the land of a guide slot, and] of a groove a light beam follows. The 5th is the system control system 8 which controls the timing of actuation of said four circuits.
[0042] Or this invention records information on the land of an optical disk, and the both sides of a groove, in reproducing, it enables record and playback of an error of little information by choosing the conditions of the above-mentioned circuit system the optimal using the L/G selection system 7.
[0043] An optical disk 1 consists of a configuration equipped with the record thin film 26 in which a detectable change is shown optically on the substrate 25 which equipped the front face with the guide slot which consists of irregularity as shown in drawing 2 . The phase change record using the deformation record and the phase condition of a thin film accompanied by configuration change changing with the heat of a light beam to a thin film as a record thin film 26, the magneto-optic recording using change of the magnetization direction, the thin film from which a record condition changes like a photochromic ingredient using light energy are applicable. Moreover, near the center of the both sides of the land of a guide slot, and a groove, a concavo-convex pit can be prepared further and it can also consider as information. In this case, informational record is impossible and serves as a medium only for playbacks.
[0044] In case the information signal recorded on the optical disk is reproduced, based on the directions from the system control system 8, a spindle motor 2 is driven by the roll control section 9, and the optical disk 1 which is a record medium is rotated at a fixed rate. Next, the control signal which shows that it is in a playback condition from the system control section 8 is inputted into the laser actuator 10, and the current which flows to the light source 11 so that the luminous intensity which carries out outgoing radiation from an optical pickup 3 may become fixed is controlled.
[0045] The light beam emitted from the light source 11 turns into a condensing beam through the optical system of pickup 3, and the last objective lens 12, and is irradiated by the optical disk 1. Incidence of the light beam reflected by the optical disk 1 is carried out to the photodetector 13 with the light-receiving side again divided into plurality through the optical system in an objective lens 12 and pickup.
[0046] A photodetector 13 carries out photo electric translation of the light which carried out incidence, and outputs the signal of the electrical potential difference corresponding to change of the quantity of light of each light-receiving side. The output signal of a photodetector 13 is amplified by pre amplifier 14, and control of a light beam location is performed using the low frequency component in it.
[0047] The focal control section 16 acquires a focal error signal using a part of output signal from each light-receiving side of a photodetector 13, drives the voice coil 15 of an optical pickup 3 according to the signal, and specifically, it controls it by moving an objective lens 12 slightly to the perpendicular

direction of an optical disk side so that an optical spot condenses on the record thin film on an optical disk 1. Moreover, the tracking control section 17 acquires a tracking control signal from the combination of other output signals of a photodetector 13, and performs control which makes radial [of an optical disk] move a voice coil 15 slightly so that a light beam may follow a guide slot.

[0048] Next, the output from the tracking control section 17 makes which field of the land of a guide slot, and a groove reverse the polarity with the polarity-reversals vessel 18 according to whether a light beam is made to follow. In addition, according to the control signal of the system control system 8, it directs in the L/G selection system 7 which performs condition selections of a land groove including the light modulation system 4 and the signal regeneration system 6, and reversal actuation with the polarity-reversals machine 18 is performed. It becomes possible to make a light beam follow the groove section of the guide slot formed on the optical disk or a land the above result.

[0049] Moreover, as fluctuation of the quality at the time of manufacture of a record medium, and/or actuation of equipment, sensibility dispersion, such as distortion of the intensity distribution of dispersion in the configuration of a guide slot and the light beam of a record regenerative apparatus or a photodetector, etc. exists. for this reason, the focal error signal produced by whether a light beam is irradiated at the land of a guide slot, and any of a groove in the case of servo actuation or a tracking-error signal -- also in any, the error voltage of the signal not originating occurs in a record medium.

[0050] In order to amend the error of these control signals, setting out of the L/G selection system 7 is interlocked with, and offset adjustment is performed to each control section. For example, by impressing minute offset to a focal control signal, the focal gap produced between a land and a groove is amended, and a tracking gap is further amended by impressing offset to a tracking control signal similarly. By considering as the above configuration, the optimal condensing condition is acquired also in any of a land and a groove.

[0051] In case a light beam is moved to an adjoining truck during tracking actuation, the pulse voltage for moving a voice coil 15 radially in an instant is superimposed on the output signal of the polarity-reversals machine 18 by the jumping circuit 19. The migration to the next groove or the next land from a land from a groove is defined as one track jump, and the migration to the next land or the next groove from the land of the reverse from a groove is defined as a half-track jump. In addition, in the case of a half-track jump, it is required to make impression and coincidence of a jumping pulse reverse the polarity of tracking with the polarity-reversals vessel 18. It becomes possible to make a light beam follow by this jumping circuit 19 on the truck of the arbitration which the system control section 8 specifies.

[0052] The binary-ized section 20 of the signal regeneration system 6 is changed into a binary-ized signal by comparing the signal level with reference level using the high frequency component of the signal from pre amplifier 14. Next, a binary-ized signal is decoded by the decoder 21 according to a predetermined signal format. Consequently, the information signal from the record mark currently formed on the optical disk 1 gets over, and data signal delivery appearance is carried out to an external device according to directions of the system control section 8.

[0053] Moreover, it restores to the information about record or playback with the land and groove which were formed in the specific field on an optical disk 1 by the L/G condition discernment section 22 if needed. As for the information recognized by the L/G condition discernment section 22, it is desirable to create a record medium, and to record and place in **********. It is the information for amending as a content the property difference produced between a land and a groove, and there is information, such as optimum conditions of the optimum conditions of an optical exposure in both sides, focal control, or tracking control and optimum conditions of a regenerative-signal recovery. Or you may be the information about the configuration of a guide slot, for example, a flute width, a channel depth, a pitch, front-face nature, etc., and after identifying this value in this case, the optimal record conditions, servo conditions, and playback conditions may be searched for from the functionality beforehand searched for from this configuration information.

[0054] Next, the difference produced between a land and a groove at the time of record is explained about the signal record to a record medium. By absorbing the irradiated light, the temperature of a

record thin film rises and most recordable record media shown so far form a record mark according to the temperature change. Therefore, even if the luminous energy to record is fixed, a difference arises in the configuration of a record mark by the degree of the thermal diffusion of a record thin film. It is thought that a difference arises on the cooling conditions after a temperature rise or temperature up according to the difference of surface states, such as surface roughness of the land and groove which are produced in the process which specifically forms a guide slot, the difference of the configuration of a guide slot edge of separating each, or the difference of the configurations of a guide slot and a record thin film.

[0055] Since it corresponds to this, when recording a signal on a record medium, the record signal S01 which consists of information recorded to predetermined timing by the system control section 8 first shown in drawing 1 is incorporated in the light modulation system 4. A record signal is changed into the record signal of a predetermined format with the encoder 23 of the light modulation system 4.

[0056] Next, to the signal changed according to the conditions of the wave setting-out section 24, division or a change on the strength of a pulse is set up, and the optical reinforcement of the light source 11 is modulated by the laser actuator 10. When the record thin film on an optical disk 1 absorbs this light that carried out intensity modulation, a record mark is formed and signal record is performed. The wave setting-out section 24 is equipped with the record pattern optimized to record to a land and a groove, and changes the output synchronizing with the output of the L/G selection system 7. Consequently, based on the modulated wave form corresponding to each of a land and a groove, intensity modulation of the light source 11 is carried out by the laser actuator 10.

[0057] It becomes possible to reproduce the information signal recorded or recorded in the signal on the record thin film on the optimal conditions to the both sides of a land and a groove by considering as the above configuration. An example detailed about each concrete actuation is explained below.

[0058] (Example 1) In case an information signal is recorded on an optical information record medium here, the example about the approach of setting up independent record conditions to each of a land and a groove is described. The difference of the heat conditions produced between a land and a groove is compensated with switching the modulated wave form of the light at the time of record to which field according to whether a signal is recorded, and little distorted record mark is obtained by it on both sides. The configuration of the wave setting-out section 24 of the light modulation system 4 is shown in drawing 3 , and the setting-out pattern generated in the wave setting-out section in drawing 4 (a) and (b) is shown. Drawing 4 (a) and (b) show the pattern used when recording on a land and a groove, respectively. Moreover, drawing 5 is the optical output outputted from an optical pickup 3 based on the signal inputted into the light modulation system 4, and the signal outputted from the light modulation system 4, and a chart which shows the timing of the record mark recorded on an optical information record medium.

[0059] The wave setting-out section 24 shown by drawing 1 consists of the object for lands, pattern setters 31 and 32 equipped with the criteria pulse patterns 31s and 32s for grooves on memory, a pattern selector 33 which chooses which the pattern, and the pulse modulation section 34 which changes a code signal into a pulse pattern like drawing 3 .

[0060] According to 7s of output signals of the L/G selector which operates corresponding to on any it shall record between a land and a groove, the pattern selector 33 chooses which output signals [of a pattern generator / 31s and 32s] pulse pattern. A pulse modulator 34 outputs the wave which outputs 34s of modulated pulses corresponding to reversal spacing of 23s of code signals of an encoder 23, and changes among the electrical potential differences ****, Vb, and Vr corresponding to the exposure power Pp, Pb, and Pr of the condensing beam on an optical information record medium to the laser actuator 10 based on the output pattern from the pattern selector 33. The laser actuator 10 does voltage-current conversion of the 34s of the output signals of a pulse modulator 34, and modulates the light source 11. As a result, pickup 3 carries out outgoing radiation of the light beam which has 11s of predetermined output waves, and predetermined information is recorded on optical information record-medium top 1.

[0061] Although only arrangement of a pulse and pulse width showed the parameter which is set as a

pattern modulator and contained in a pulse pattern by drawing 4 and 5, it is also still more effective spacing of a pulse and to change the height (exposure power) of a pulse further. What is necessary is just for the configuration of the record mark especially formed on a record medium between a land and a groove to be equivalent, and to set up this exposure power corresponding to a land and a groove, when it is the difference of only magnitude, or when it is the modulation technique which cannot receive the difference of the configuration of a record mark easily. In this case, a setting-out circuit can simplify substantially.

[0062] The pulse pattern set as the pattern setters 31 and 32 has mark length record as shown in drawing 4 , when carrying out intensity modulation based on the level of 23s of encoder outputs, and mark location record whenever the level of 23s of encoder outputs is reversed, when generating a pulse.

[0063] When it corresponds to mark length record, as shown in drawing 5 , the multi-pulse modulation approach which forms two or more pulse trains to one signal reversal is used. When light is irradiated at an optical information record medium, this is used in order to prevent that a record mark is distorted by heat transfer on a record thin film. That is, at the part and the start edge point of record which the signal reversed, it is high in an energy density and a symmetrical record mark is recorded by setting up an energy density small after that. Consequently, the temperature of a record thin film becomes almost fixed by the start edge and the trailer of record, and a symmetrical record mark can be obtained.

[0064] However, as mentioned above, by the land and the groove, even if the exposure conditions of light are the same, heating / cooling conditions of record film differ. For this reason, in this invention, the pulse pattern which are the exposure conditions of the optimal light is set up to each. If the period of a clock is set to T when an encoder 23 corresponds to the EFM (8 -14 conversion) modulation used with the compact disk etc., reversal spacing of 23s of signals will become nine kinds of 3T-11T.

[0065] In this case, as shown in drawing 4 (a) and (b), in order to record on a land and a groove, the pattern setters 31 and 32 are made to memorize nine kinds of setting-out patterns, respectively. And nine kinds of patterns read from the pattern setters 31 and 32 are outputted from the pattern selector 33, and the pattern of the period corresponding to reversal spacing of 23s of outputs of an encoder is chosen by the pulse modulation section 34.

[0066] It becomes a configuration with an easy pattern generator [that what is necessary is just to set up one kind of pulse pattern which becomes pattern generators 31 and 32 from a pulse width and power value since the configuration of the record mark which forms on an optical information record medium on the other hand in mark location record is the same and the spacing serves as an information signal to a land and a groove, respectively / mark length record].

[0067] So far, although the pulse pattern corresponding to a land and a groove showed how to memorize inside the memory of pattern generators 31 and 32 beforehand, when it corresponds to the record medium with which classes differ, or when it is going to perform high record of quality further, it has two approaches shown below.

[0068] Before record of an information signal, the 1st approach performs preliminary record (it tries, writes and records) beforehand, and amends the property differences in a land and a groove including adhesion of the dust to the temperature change, the record medium, or optical system dispersion between optical information record media, the difference between record regenerative apparatus, and around a record regenerative apparatus etc.

[0069] In this case, if the fluctuation factor which gives fluctuation to the record conditions of a record medium is detected, the optimal pulse pattern will be chosen by recording by trying each time and writing, and it will consider as the configuration which resets a pulse pattern. Drawing 8 is a flow chart which tries and writes and explains a process, and drawing 6 shows the perspective view of an optical disk. Drawing 7 shows the pulse pattern used for trying and writing. Referring to these drawings, it tries and writes and a process is explained.

[0070] Actuation starts a trial writing process by inputting into the system control section 8 the reference signal S03 which shows that the fluctuation factor of the optical information record medium shown in drawing 1 occurred. As shown in drawing 8 , trial writing begins with directions of the initiation 81 of trial writing from the system control section 8. As shown in drawing 6 , the location of the light beam 27

used for record playback is moved to the information field 61 of an optical disk 1, and the test field 62 to which it approached on the same flat surface with migration-to test field 62 of optical disk 1 82 directions.

[0071] Next, the 1st pulse pattern in the record conditioning machine 36 (drawing 3 R> 3) which memorized two or more pulse patterns is read into the pattern setters 31 and 32 with directions of the pattern setting out 83.

[0072] Next, the actuation circuit 10 is operated according to said record pattern (drawing 1), and modulation light is first irradiated on a groove with directions of the optical exposure 84. Then, a series of optical exposures are performed on a land by the same approach.

[0073] As the example of 15 kinds of pulse patterns of 11T is shown in drawing 7 , the record conditioning machine 36 sets up a recording start point and the pulse pattern to which the energy distribution after it was changed to the conditions of the environment which uses a record medium and equipment so that a symmetrical record mark may be obtained. These pulse patterns carry out the sequential output of 15 kinds of patterns in this example according to the distinction result of the following pulse pattern's existence check 85. Consequently, on a record medium, the record mark of a configuration which corresponds to record conditions and is different is formed.

[0074] Next, signal regeneration from the record mark on a record medium is performed. The optimal record conditions are searched for by detecting the error rate of the regenerative signal from each record mark in the error detection process 86, and comparing the value at the error rate comparison process 87 in that case. Detection of an error rate is performed using the error correction signal generated in the process which restores to data by the decoder 20, an error rate comparison is carried out by the system control section 8, it is searching for the record conditions from which the error rate's became min, and selection of the optimal pattern is performed. by this thing [trying and writing and performing a process to the both sides of a land and a groove], it is alike, respectively, it receives and can ask for the optimal pulse pattern.

[0075] This time amount that tries, and writes and a process takes is shortened, or it is also possible to skip this process one by one to simplify a circuit. The correlation between a land and a groove is searched for beforehand, for example, trial writing is performed only on a land, and it is the optimal pulse pattern ****** of a land. Next, it can ask for the pulse pattern of a groove based on the above-mentioned functionality.

[0076] When fixed time amount passed after carrying out record conditioning to them, when the temperature of an operating environment changes to the conditions which operate the record conditioning machine 6, i.e., the conditions from which a reference signal S03 will be in operating state, more than fixed at the time of starting of a disk drive at the time of exchange of an optical disk, the error more than fixed may have been detected from the regenerative signal. The change between a disk and each of a drive or a mutual fluctuation element can be guaranteed by detection at the time of disk-swapping or starting of a drive. Moreover, fluctuation of the temperature dependence of a record medium or the control state of a drive can be compensated with managing the time amount progress from the temperature change of an operating environment, and record conditioning.

[0077] The 2nd approach corresponds to each of a land and a groove the optimal record conditions and by [a certain] being and recording the identifier of record conditions on the specific field of an optical information record medium beforehand. An identifier is equipped with the information on the optimal pulse pattern for the both sides of a land and a groove, and establishes it with the gestalt which applies to the inner circumference section and the periphery section outside the information field of an optical disk at an information signal or an address signal. For example, the location equivalent to the information field 61 of the optical disk 1 shown by above-mentioned drawing 6 R> 6 and the test field 62 of the field where it approached on the same flat surface may be used.

[0078] although the gestalt of the identifier in this case may be the same format as an information signal, it is desirable it to be desirable that it is a code signal with low recording density relatively, and to prepare in the land of a guide slot or either of the grooves from a viewpoint of carrying out reading appearance and raising precision, further to an information signal. Like an information signal, the

identifier of this gestalt is processed in the signal regeneration system 6, and after it makes a regenerative signal binary on predetermined level, it restores to that information with the L/G condition recognition vessel 22. Based on this result, the system control section 8 sets up the record conditions of the light modulation system 4.

[0079] According to the magnitude of the equipment which prints information, such as considering as a specific configuration, and preparing semiconductor memory, various gestalten can be taken to a part of guard plate formed as a gestalt which prepares other identifiers in order to protect a medium, or cartridge. In the phase which equipped the record regenerative apparatus with the optical information record medium for the information from these identifiers, it reads by the system control section 8, and a pattern is set as pattern generators 31 and 32 according to the content. It becomes possible to set up the exposure conditions of light the optimal by considering as the above-mentioned configuration according to the class of record medium.

[0080] By considering as the above configurations, according to the reference signal for the record conditioning of an optical disk, setting out of record conditions is performed each time, data can be recorded in the always optimal condition, and the dependability as a data recorder improves.

[0081] (Example 2) Here, in case a light beam is irradiated at an optical information record medium, by changing servo conditions by the land and the groove explains how to make possible the tracking for following the optimal focusing and the guide slot on the both sides.

[0082] As a focusing technique which condenses the light beam to an optical information record medium, although the knife-edge method or the astigmatism method is learned, since the location precision of an optic is required, the knife-edge method has the technical problem that a detection system becomes large. On the other hand, if an astigmatism method is used, the miniaturization of a detection system will become easy. However, if it is going to double a focus with the both sides of the land made into the object of this invention, and a groove, in the ideal condition, the difference of focus control will not be produced in a land and a groove, but if a slight distortion exists in the configuration or the beam spot of a guide slot, the problem that a difference arises [distribution of the reflected light beam from a record medium] to the pattern on a photodetector 13 will occur.

[0083] The approach of compensating with this example the difference of the optical spot on the photodetector 13 produced between a groove and a land by impressing offset to a focusing control signal is applied.

[0084] The detail of the focal control section 16 is shown in drawing 9 . From the signal about the focal control in 14s of output signals of pre amplifier, 90s of focal error signals is acquired by the focal error detector 90, 16s of focal control signals is acquired by the focal actuation circuit 92 through the focal compensating circuit 91, the voice coil 15 of an optical pickup 3 is driven based on this signal, and focal control is performed.

[0085] The offset compensating circuit 91 is considered as the configuration which can set up two or more offset levels according to the signal from the outside. The offset inputted into the offset compensating circuit 91 is generated in the offset setter 95 which sets up the offset in the case of the half-track jump actuation which carries out a track jump to a land from a groove or a groove from the offset setter 94 at the time of carrying out tracking to the offset setter 93 which sets up the offset at the time of carrying out tracking to a land, and a groove, and a land.

[0086] In the offset selector 96, which signal of the above-mentioned offset setters 93 and 94 is outputted corresponding to 7s of outputs of the L/G selection system 7. Moreover, it will be set to the output level of the offset setter 95 if directions of a half-track jump are inputted into the offset selector 96 from the system control section.

[0087] When offset setting out of the above-mentioned half track jump is remarkable and its level difference between the offset setter 93 and 94 is large, it uses in order to carry out actuation before and behind a track jump to stability, and when said level difference is small, it can omit.

[0088] On the other hand, the focal actuation circuit 92 outputs 16s of signals which make 91s of inputted signals phase murder zero, and drives a voice coil 15. The gain used for this focal actuation circuit 92 is generated in the gain setter 98 which sets up the gain at the time of carrying out tracking to

the gain setter 97 and groove which set up the gain at the time of carrying out tracking to a land. In the gain selector 99, which signal of the above-mentioned gain setters 97 and 98 is outputted corresponding to 7s of outputs of the L/G selection system 7. It becomes possible to set up the optimal focal condition to the both sides of a land and a groove by considering as the above configuration.

[0089] If the optimal condition is set up by the land and the groove also about tracking control, still better record playback will be attained. Drawing 10 shows the detail of the tracking control section 17. 100s of tracking-error signals is acquired from the signal about the tracking control in 14s of output signals of pre amplifier by the tracking-error detector 100, 17s of focal control signals is acquired by the tracking actuation circuit 102 through the tracking compensating circuit 101, and tracking control is performed by driving the voice coil 15 of an optical pickup through the polarity-reversals machine 18.

[0090] The tracking compensating circuit 101 is considered as the configuration which can set up two or more offset levels according to the signal from the outside. The offset inputted into the tracking compensating circuit 101 is generated in the offset setter 105 which sets up the offset in the case of the half-track jump actuation which carries out a track jump to a land from a groove or a groove from the offset setter 104 at the time of carrying out tracking to the offset setter 103 which sets up the offset at the time of carrying out tracking to a land, and a groove, and a land.

[0091] In the offset selector 106, which signal of the above-mentioned offset setters 103 and 104 is outputted corresponding to 7s of outputs of the L/G selection system 7. Moreover, it will be set to the output level of the offset setter 105 if directions of a half-track jump are inputted into the offset machine 106 from the system control section.

[0092] When offset setting out of the above-mentioned half track jump is remarkable and its level difference between the offset setter 103 and 104 is large, it uses in order to carry out actuation before and behind a track jump to stability, and when said level difference is small, it can omit.

[0093] On the other hand, the tracking actuation circuit 102 outputs 17s of signals which make 101s of inputted signals phase murder zero, and drives a voice coil 15. The gain used for this tracking actuation circuit 102 is generated in the gain setter 108 at the time of carrying out tracking to the gain setter 107 and groove which set up the gain at the time of carrying out tracking to a land. In a gain selection circuitry, which signal of the above-mentioned offset setters 107 and 108 is outputted corresponding to 7s of outputs of the L/G selection system 7. It becomes possible to set up the optimal tracking condition to the both sides of a land and a groove by considering as the above configuration.

[0094] Furthermore, in order to set up the optimal focal conditions or tracking conditions, like the trial record shown in the example 1, before record playback of a signal, servo conditions may be changed gradually and record playback may be performed. This process can use the procedure which was explained using drawing 8 and which tries, writes and applies to a process.

[0095] When setting up focal conditions, 8s of system control signals is made to input into the offset setters 93, 94, and 95 and the gain setters 97 and 98 through the focal conditioning machine 141, as shown in drawing 9 . As shown in drawing 11 , with directions of the test playback initiation 111, a light beam makes the test zone on an optical disk take migration 112, the truck top with which the criteria record mark is recorded beforehand is scanned, and playback of a signal is started.

[0096] Then, in the servo conditioning process 113, based on the signal of the focal conditioning machine 141, focal offset and one focal gain are set up, then, it restores to a signal according to the error rate detection process 114, and an error rate is evaluated. Furthermore, the next servo conditions of the focal conditioning machine 141 are checked according to the servo conditions' existence check process 115. When the setups which are not performed yet remain, the servo conditioning process 113 is repeated and performed and setups are performed altogether. The obtained result is compared in the error rate comparison process 116, and the optimal focal conditions are determined.

[0097] As shown in drawing 10 also to tracking conditions, 8s of system control signals is made to input into the offset setters 103, 104, and 105 and the gain setters 107 and 108 through the tracking conditioning machine 142, and the procedure shown in drawing 13 R> 3 determines the optimal tracking conditions.

[0098] Moreover, although how to reproduce the criteria record mark currently beforehand recorded on

the test field here was shown, it is also possible to search for the servo conditions at the time of record by recording by trying focusing conditions or tracking conditions on the condition of having made it changing by the same approach as the above-mentioned, further, and restoring to the regenerative signal from each record mark. The process in this case should just add the optical exposure process which records between the setting-out process 113 of servo conditions, and the error rate detection process 114.

[0099] Thus, it becomes an only different value in many cases on the optimal servo conditions at the time of the record searched for, and the optimal conditions at the time of playback. In order to correspond to this, it realizes by adopting which value or switching a servo condition by record and playback if needed. By considering as the above configuration, it becomes recordable to a land and a groove corresponding to fluctuation of between disks or a record regenerative apparatus.
[0100] (Example 3) The process which changes record conditions by the land and the groove at the time of the above-mentioned record is skipped or simplified, and here explains the example attached to the approach of changing recovery conditions in the case of a groove [a land and], in case it restores to an information signal based on the reflected light of the light beam which irradiated the optical information record medium. Here, it aims at amending a signal amplitude difference and the difference of the mark length dependency of signal amplitude in the difference produced between the land of a regenerative signal, and a groove. In addition, the gain produced between the shortest record mark in the record mark formed in an information signal corresponding to the mark length dependency of signal amplitude and the longest record mark is meant.
[0101] Drawing 12 shows the detail of the binary-ized section 20. Output-signal 14s of pre amplifier carry out a high frequency component output, the signal of a high frequency component is further amplified by the equalizing circuit 121 in the signal band in an input signal, and the high bandwidth transparency filter (H.P.F.) 120 is outputted as 121s of signals. 121s of signals is inputted into a decoder 21 as 20s of binary-ized signals through a comparator circuit 122 and the phase compensating circuit 129, and an information signal restores to them. Moreover, 20s of binary-ized signals is inputted into the L/G condition discrimination circuit 22 as shown in drawing 1 , and they perform the monitor of a playback condition.
[0102] The equalizing circuit 121 is considered as the configuration which can set equalizing characteristics, such as a frequency band of equalizing, and gain, as arbitration according to the signal from the outside. The gain setter 123 which sets up the gain at the time of carrying out tracking to a land, and the gain setter 114 which sets up the gain at the time of carrying out tracking to a groove are connected through the gain selector 125 in the equalizing circuit 121. The gain selector 125 outputs one side of the value set up by the gain setters 123 and 124 to the equalizing circuit 121 based on 7s of outputs of the L/G selection system 7. The equalizing circuit 121 equalizes the signal which passed the high bandwidth transparency filter 120 based on the setting-out gain received gain selector 125, and outputs it as 121s of signals.
[0103] As compared with reference level, as for a comparator circuit 122, at least the acquired binary-ized signal outputs 121s of signals to the phase compensating circuit 129. The phase of binary-ized ****** is compensated and the phase compensating circuit 129 outputs it as 20s of binary-ized signals by which phase compensation was carried out. The slice level used as the reference level of this comparator circuit 122 is set up in the level setter 127 which sets up the level at the time of carrying out tracking to the level setter 126 which sets up the level at the time of carrying out tracking to a land, and a groove.
[0104] Based on 7s of outputs of the L/G selection system 7, the level selector 128 outputs which the set point of the level setters 126 and 127 to a comparator circuit 122, and gives reference level to a comparator 122.
[0105] By the above configuration, a regenerative signal is made binary with the optimal slice level to the both sides of a land and a groove. By carrying out signal processing of the information signal recorded on the land and the groove on the conditions which carried out mutually-independent, it becomes possible to reduce the recording characteristic difference produced by the land and the groove.

[0106] Furthermore, it is effective to establish the playback conditioning process of deciding playback conditions beforehand as well as trial writing of an example 1 as an approach of setting up the optimal equalizing conditions or slice conditions. when setting up playback conditions, it makes 8s of system control signals boil and input into the gain setters 123 and 124 and the level setters 126 and 127 through the playback conditioning machine 143, as shown in drawing 12 although the procedure which was explained using drawing 8 and which tries, writes and applies to a process can be used for this process
[0107] As shown in drawing 13 , with directions of the test playback initiation 131, a light beam is moved to the test field on an optical disk, the truck top with which the criteria record mark is recorded beforehand is scanned, and playback of a signal is started. Then, in the playback conditioning process 133, based on the signal of the playback conditioning machine 143, an equalizing characteristic and one slice level are set up, then, it restores to a signal according to the error rate detection process 134, and an error rate is evaluated. Furthermore according to the playback conditions' existence check process 135, the next playback conditions of the playback conditioning machine 143 are checked. When the ****** conditions which are not performed yet remain, the playback conditioning process 133 is repeated and performed and setups are performed altogether. The obtained result is compared in the error rate comparison process 136, and the optimal playback conditions are determined.
[0108] It becomes reproducible [the signal recorded on the land and the groove by the above configuration corresponding to fluctuation of between disks or a record regenerative apparatus]. Moreover, the quality as a record regenerative apparatus can be further raised by establishing the record conditioning process shown in the examples 1 and 2 before this playback conditioning process.
[0109] In the examples 1-3, although a record medium was not explained in full detail, this invention is applicable to all the record media that have a detectable record condition optically. Moreover, the include angle of the field of the slant face of the channel depth and land which are the shape parameter of a slot, and a groove boundary was not explained in full detail, and, as for constraint of this invention, these do not become, either.
[0110] Although how to compensate the difference of the property which separates this invention with a control system in a light modulation system and the example 2, separates it with a signal regeneration system by the example 3 in the example 1, and is produced between a land and a groove has been explained, it is in ** that the above-mentioned conditions are combined, or it can simplify and apply according to the property of a record medium and the signal level of a record regenerative apparatus to need.
[0111]
[Effect of the Invention] Since record conditions are changed according to whether the tracking of any of the crevice of a guide slot and heights is carried out according to this invention, it becomes recordable [which compensated the heating cooling property at the time of the record produced between a groove and a land], and it is stabilized and information can be recorded.
[0112] Moreover, distortion of the regenerative signal produced at the time of the focus and tracking error which produce the crevice and heights of a guide slot to the difference which carries out tracking, or a signal recovery can be compensated independently. Therefore, according to this invention, it is the land of a guide slot, and reading in the both sides of a groove, and few optical record regenerative apparatus of an error are obtained.
[0113] Moreover, by preparing a property identifier, compensation of individual difference is attained, it is reading and few optical record media are obtained in an error.

[Translation done.]

* NOTICES *

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram showing the configuration of the optical information record regenerative apparatus of this invention
[Drawing 2] Some block diagrams of the optical information record medium of this invention
[Drawing 3] The block diagram showing the configuration of the wave setting-out section of the 1st example
[Drawing 4] It is a signal waveform diagram in the case of recording (a) on a land with the signal waveform diagram of the pattern setter of the 1st example.
(b) is a signal waveform diagram in the case of recording on a groove.
[Drawing 5] The signal wave form of the wave setter of the 1st example, and drawing of a record condition
[Drawing 6] The block diagram of the optical information record medium of the 1st example
[Drawing 7] The signal waveform diagram of the record conditioning machine of the 1st example
[Drawing 8] The flow chart of the record conditioning of the 1st example
[Drawing 9] The block diagram showing the configuration of the focal control section of the 2nd example
[Drawing 10] The block diagram showing the configuration of the tracking control section of the 2nd example
[Drawing 11] The flow chart of the servo conditioning of the 2nd example
[Drawing 12] The block diagram showing the configuration of the binary-ized section of the 3rd example
[Drawing 13] The flow chart of the playback conditioning of the 3rd example
[Description of Notations]
1 Optical Disk
2 Motor
3 Optical Pickup
4 Light Modulation System
5 Control System
6 Signal Regeneration System
7 L/G Selection System
8 System Control System
9 Roll Control
10 Laser Actuator
11 Light Source
12 Objective Lens
13 Photodetector
14 Pre Amplifier
15 Voice Coil

16 Focal Control Section
17 Tracking Control Section
18 Polarity-Reversals Machine
19 Jumping Circuit
20 Binary-ized Section
21 Decoder
22 LG Condition Recognition Machine
23 Encoder

[Translation done.]

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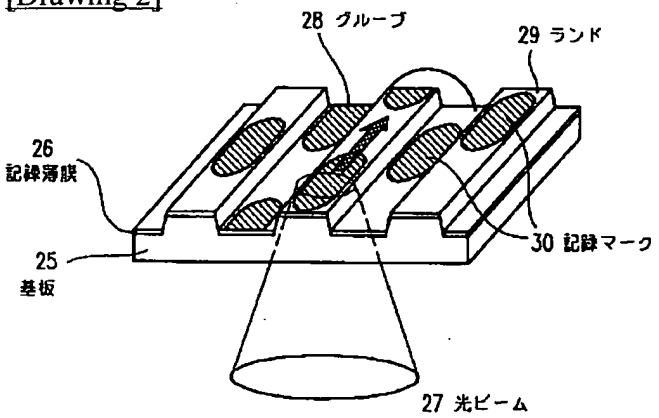
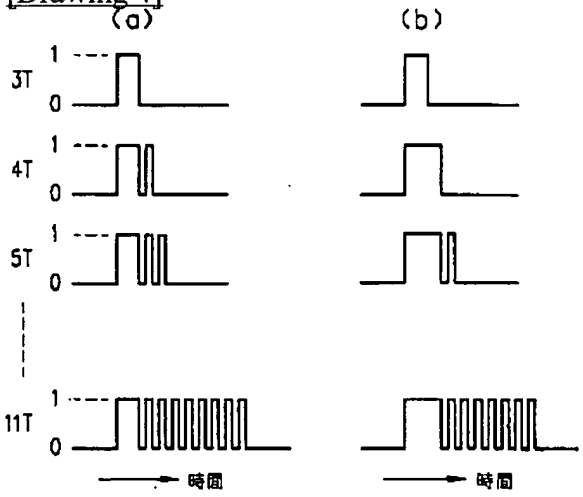
DRAWINGS

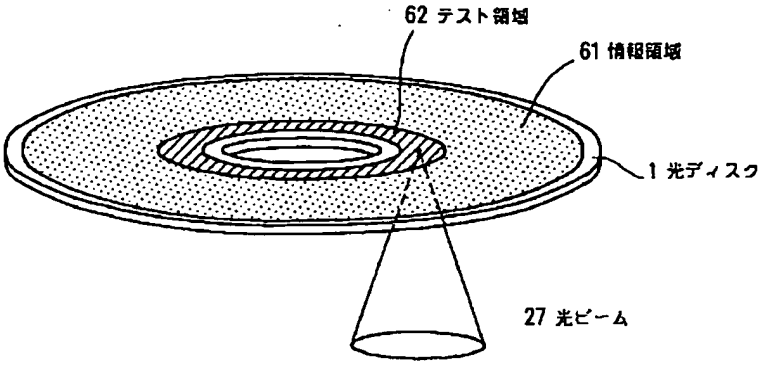
[Drawing 2]



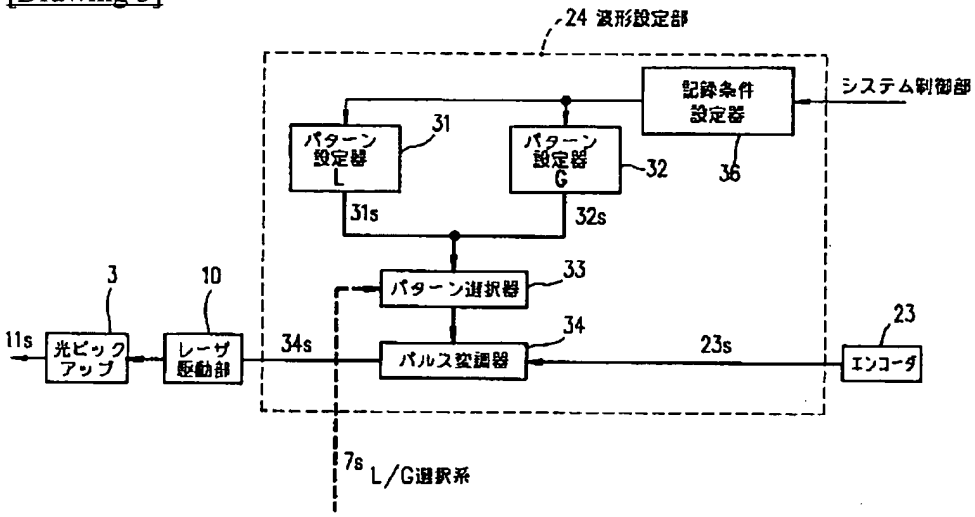
[Drawing 4]



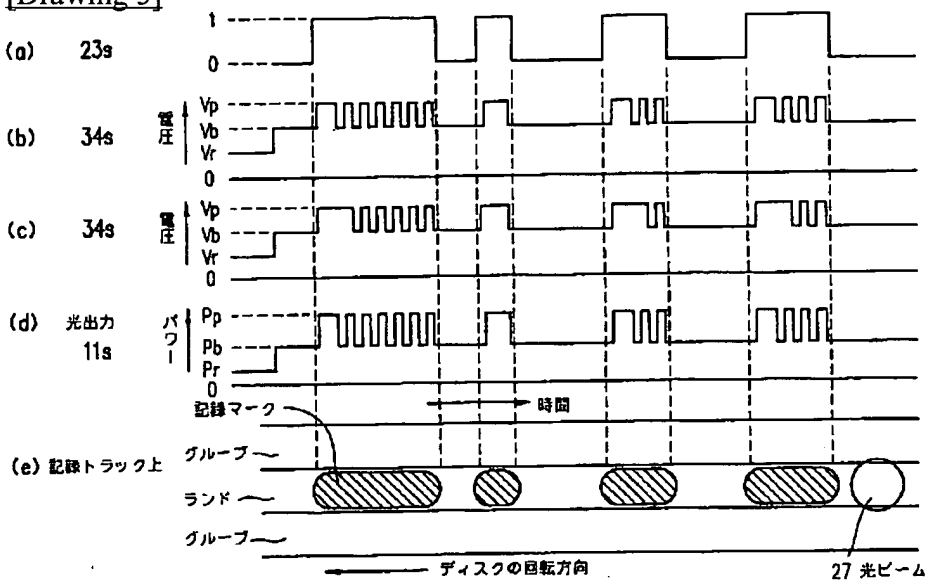
[Drawing 6]



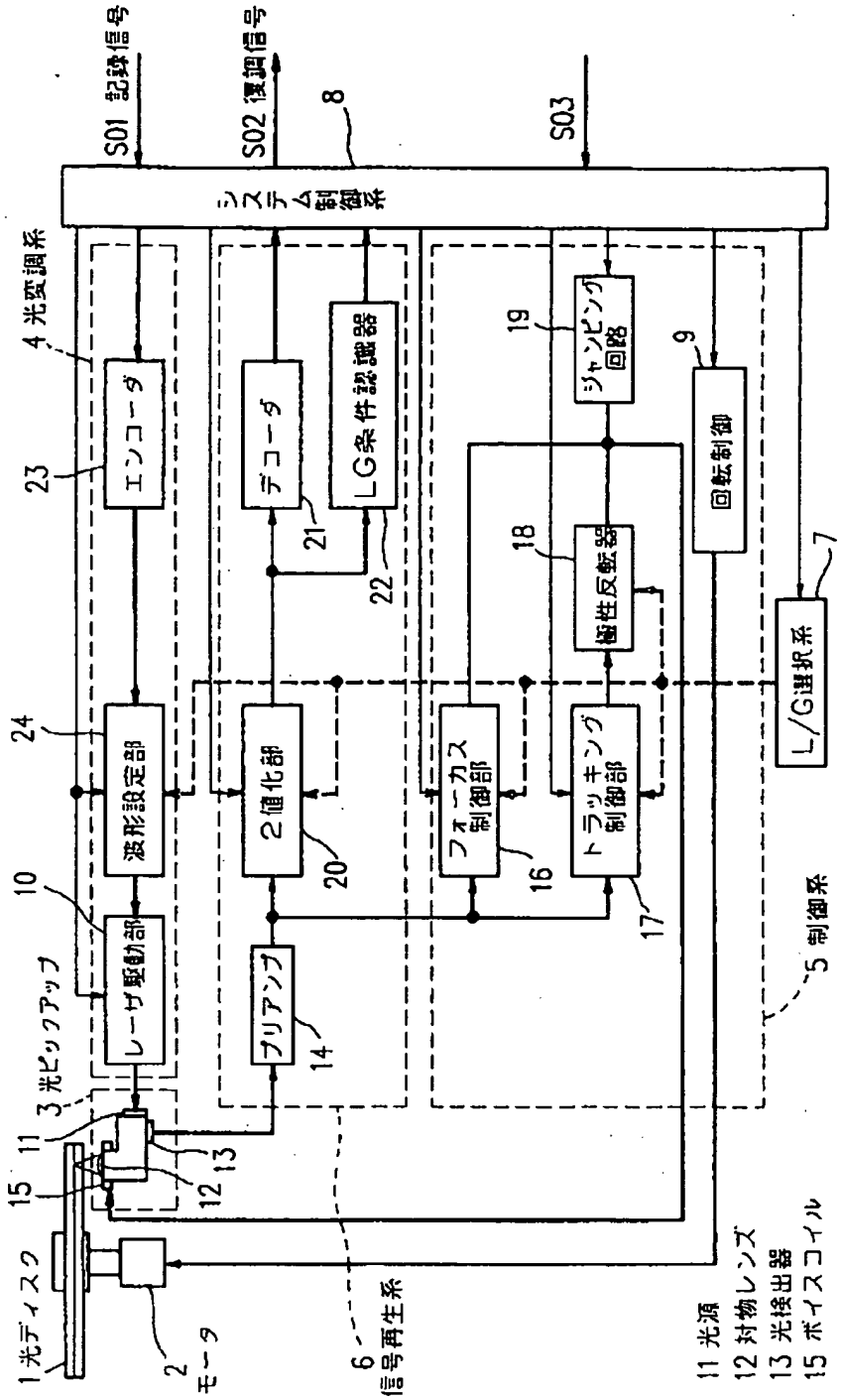
[Drawing 3]



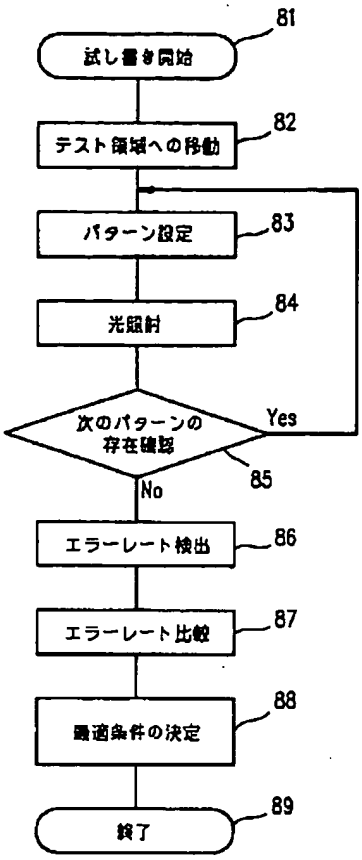
[Drawing 5]



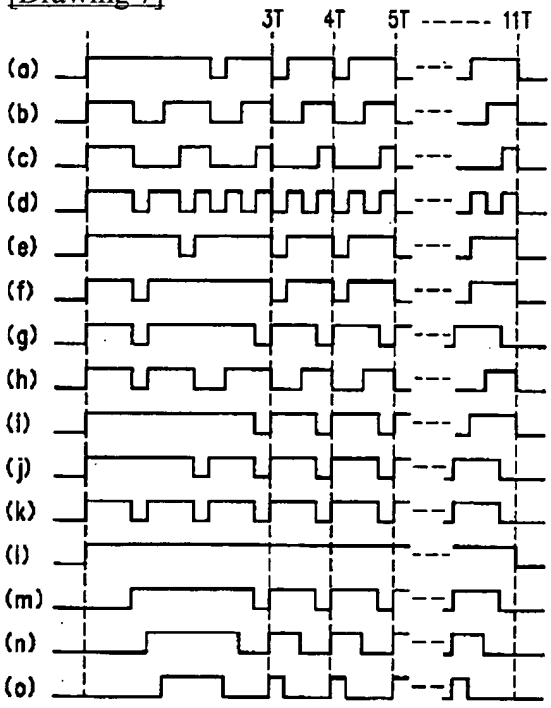
[Drawing 1]


S01 記録信号
S02 復調信号
S03
8
システム制御系
4 光変調系
エンコーダ
デコーダ
LG条件認識器
ジャンピング回路
19
9
回転制御
23
21
22
18
極性反転器
7
L/G選択系
24
波形設定部
2値化部
フォーカス制御部
トラッキング制御部
10
レーザ駆動部
プリアンプ
20
16
17
5 制御系
3 光ピックアップ
11
13
12
15
1 光ディスク
2 モータ
6 信号再生系
11 光源
12 対物レンズ
13 光検出器
15 ボイスコイル

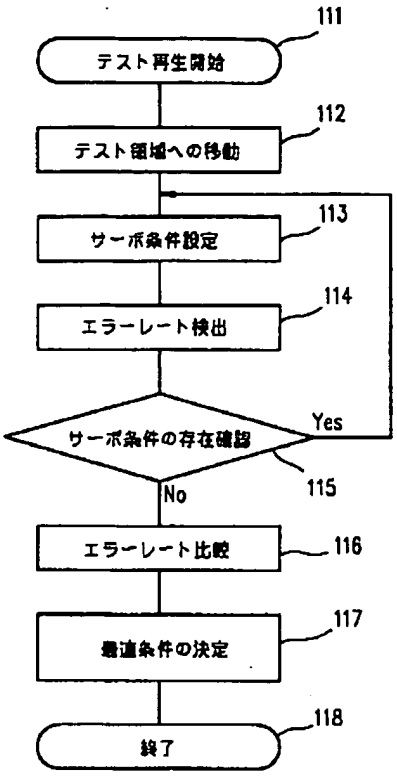
[Drawing 8]



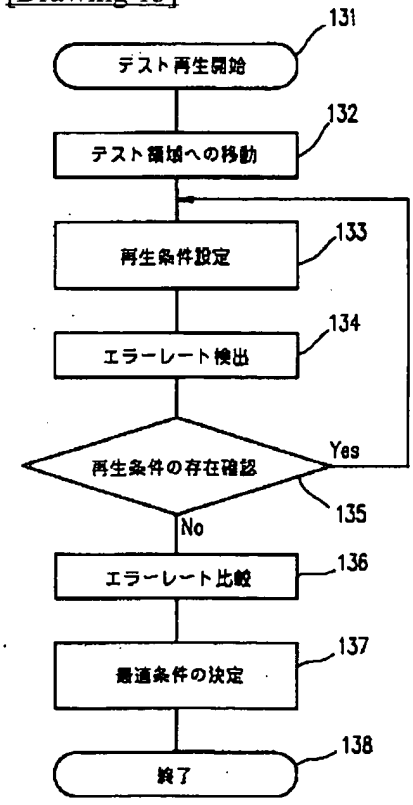
[Drawing 7]



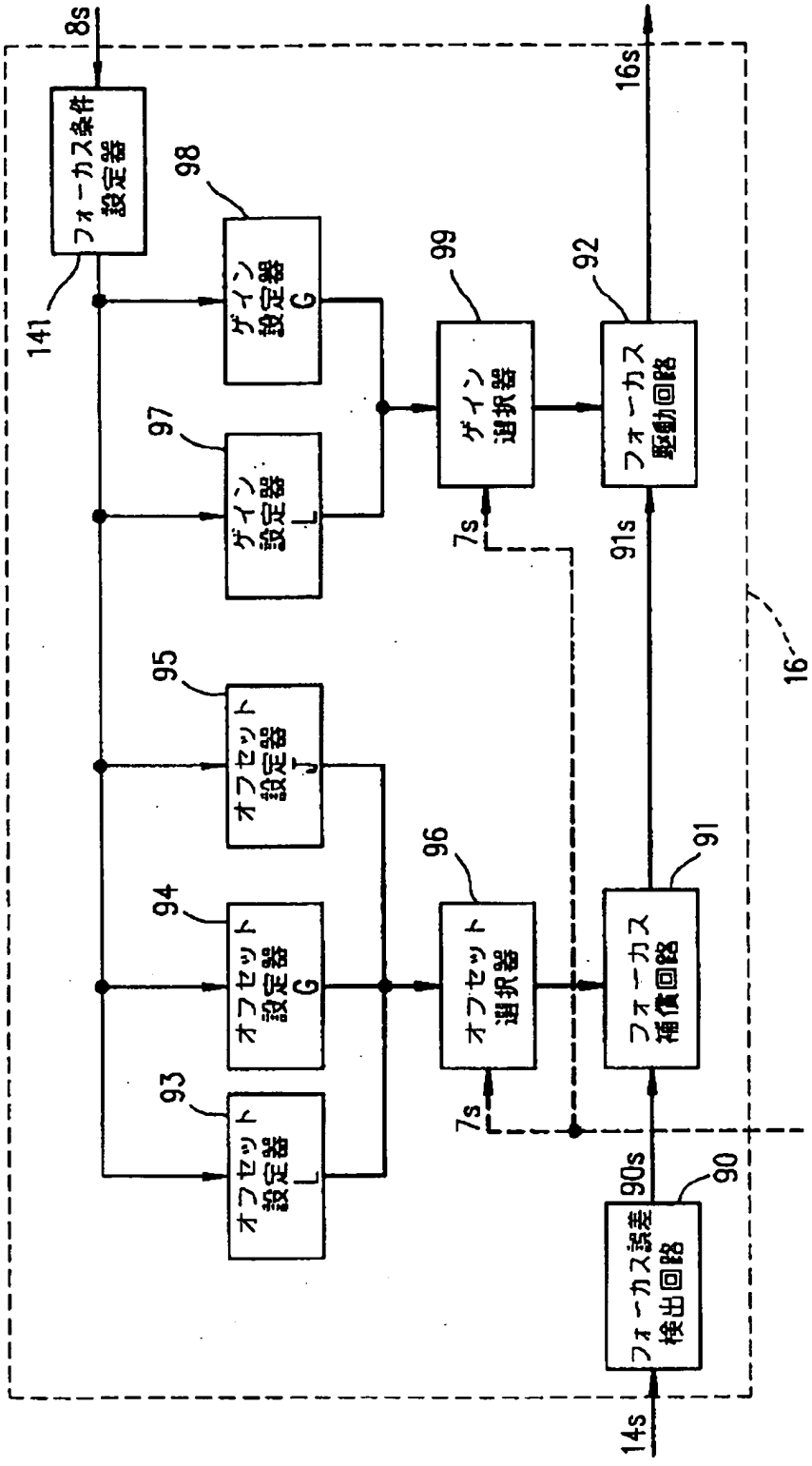
[Drawing 11]



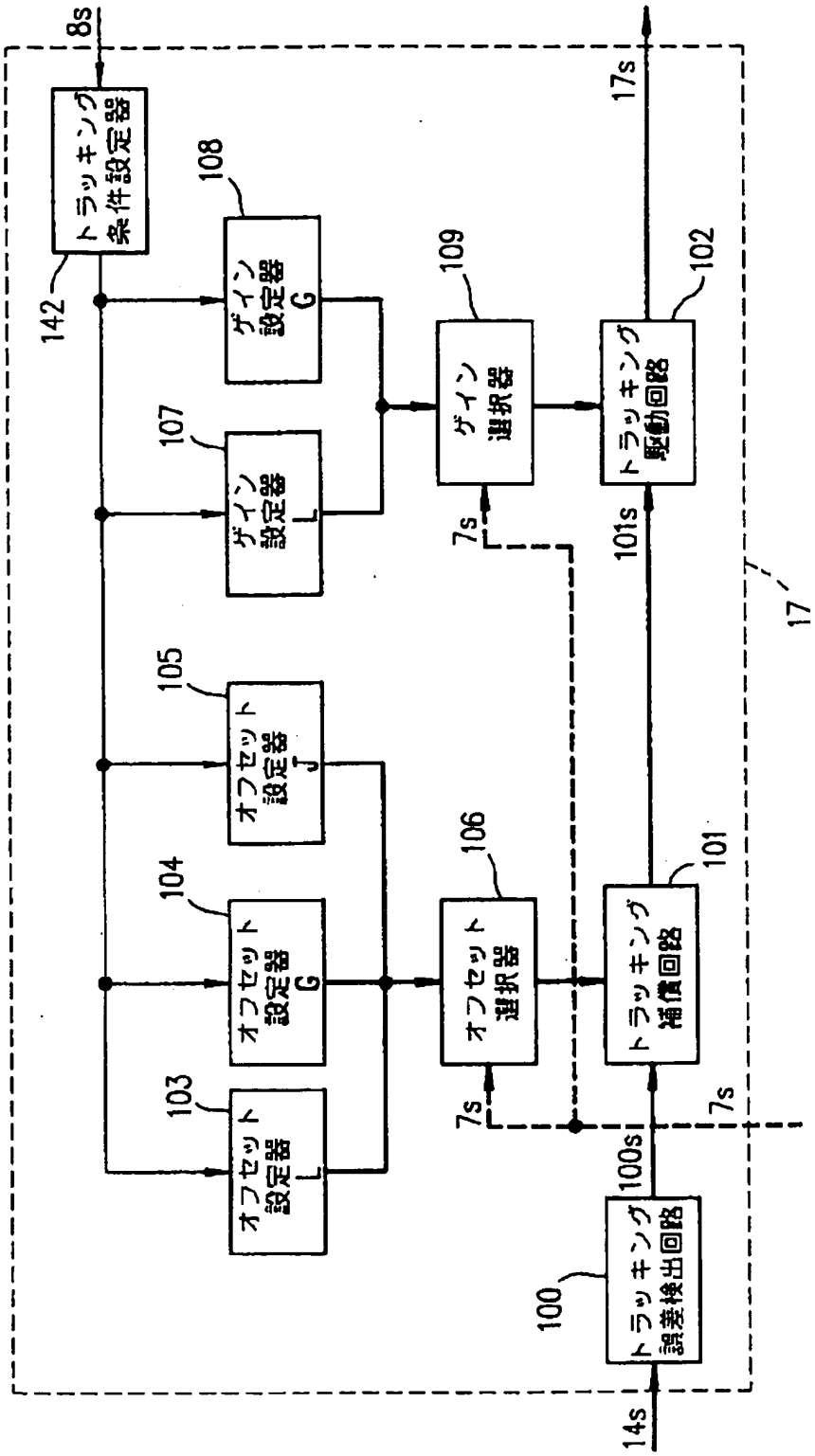
[Drawing 13]



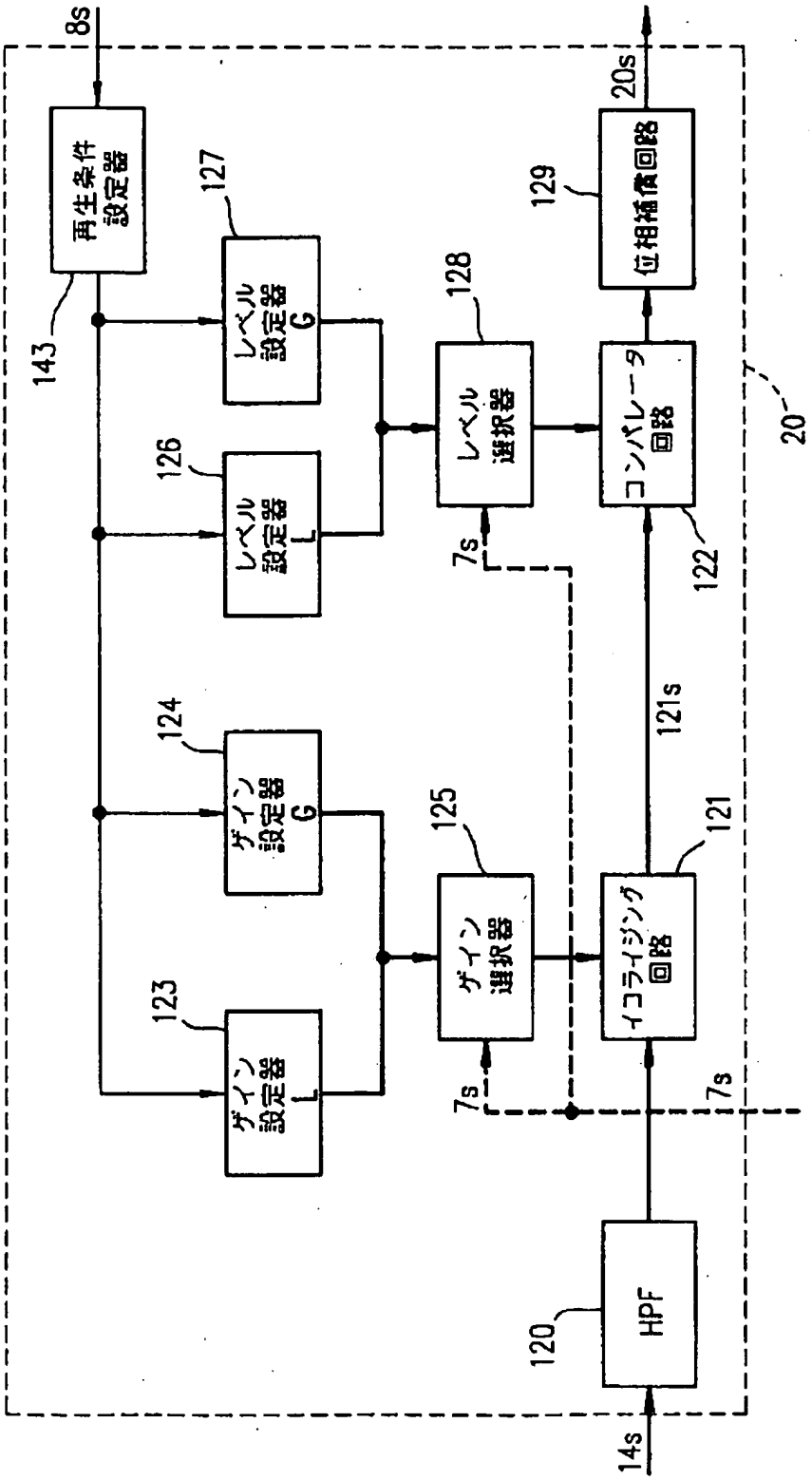
[Drawing 9]


8s
フォーカス条件設定器
141
98
ゲイン設定器 G
97
ゲイン設定器 L
99
ゲイン選択器
92
フォーカス駆動回路
16s
7s
91s
16
95
オフセット設定器 U
94
オフセット設定器 G
93
オフセット設定器 L
96
オフセット選択器
91
フォーカス補償回路
7s
90s
90
フォーカス誤差検出回路
14s

[Drawing 10]


8s
トラッキング条件設定器
142
108
ゲイン設定器 G
107
ゲイン設定器 L
109
ゲイン選択器
102
トラッキング駆動回路
17s
7s
101s
17
105
オフセット設定器 J
104
オフセット設定器 G
103
オフセット設定器 L
106
オフセット選択器
101
トラッキング補償回路
7s
7s
100s
100
トラッキング誤差検出回路
14s

[Drawing 12]



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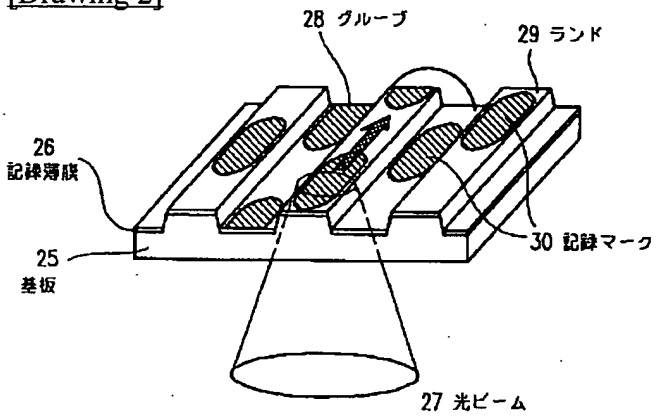
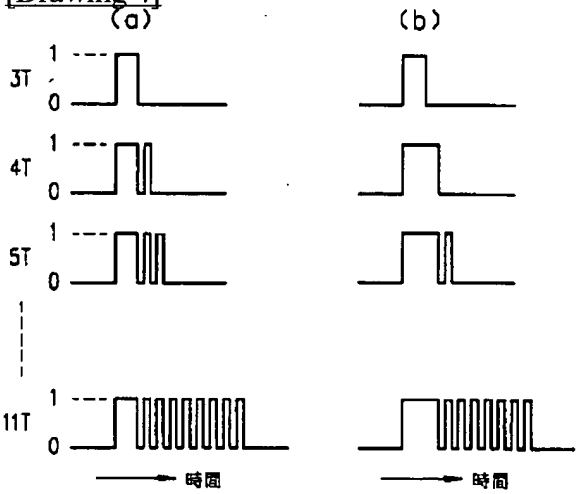
DRAWINGS

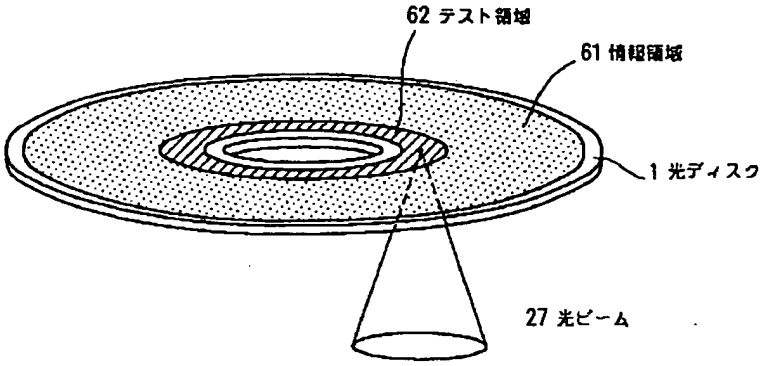
[Drawing 2]



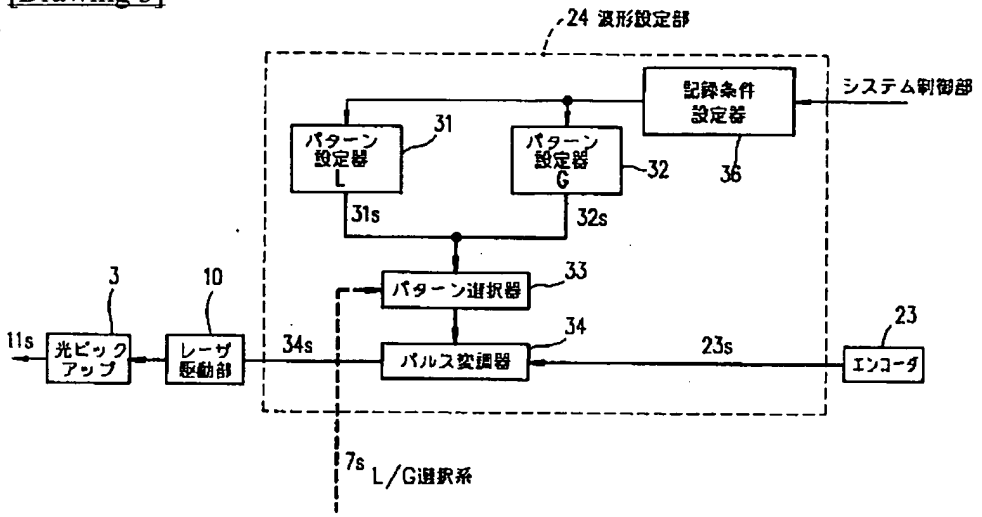
[Drawing 4]



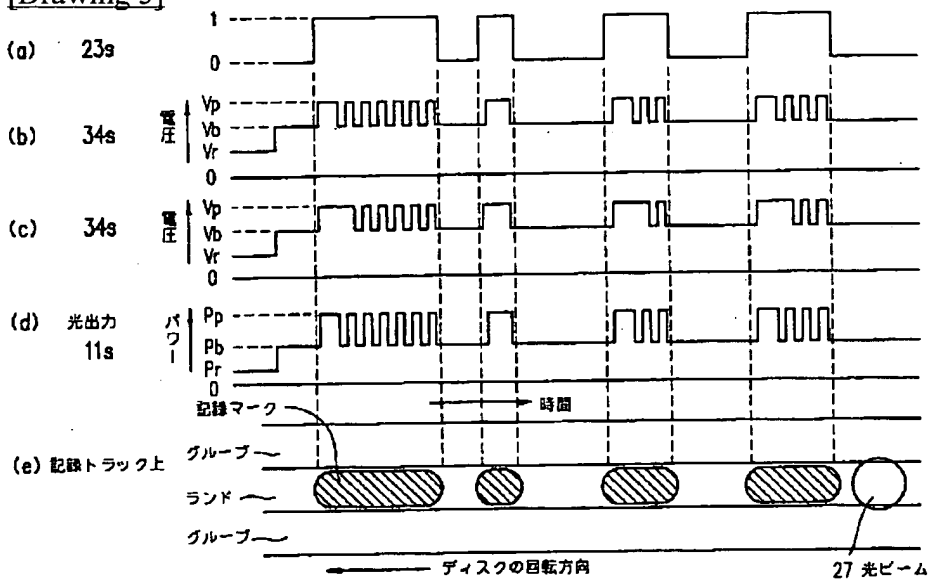
[Drawing 6]



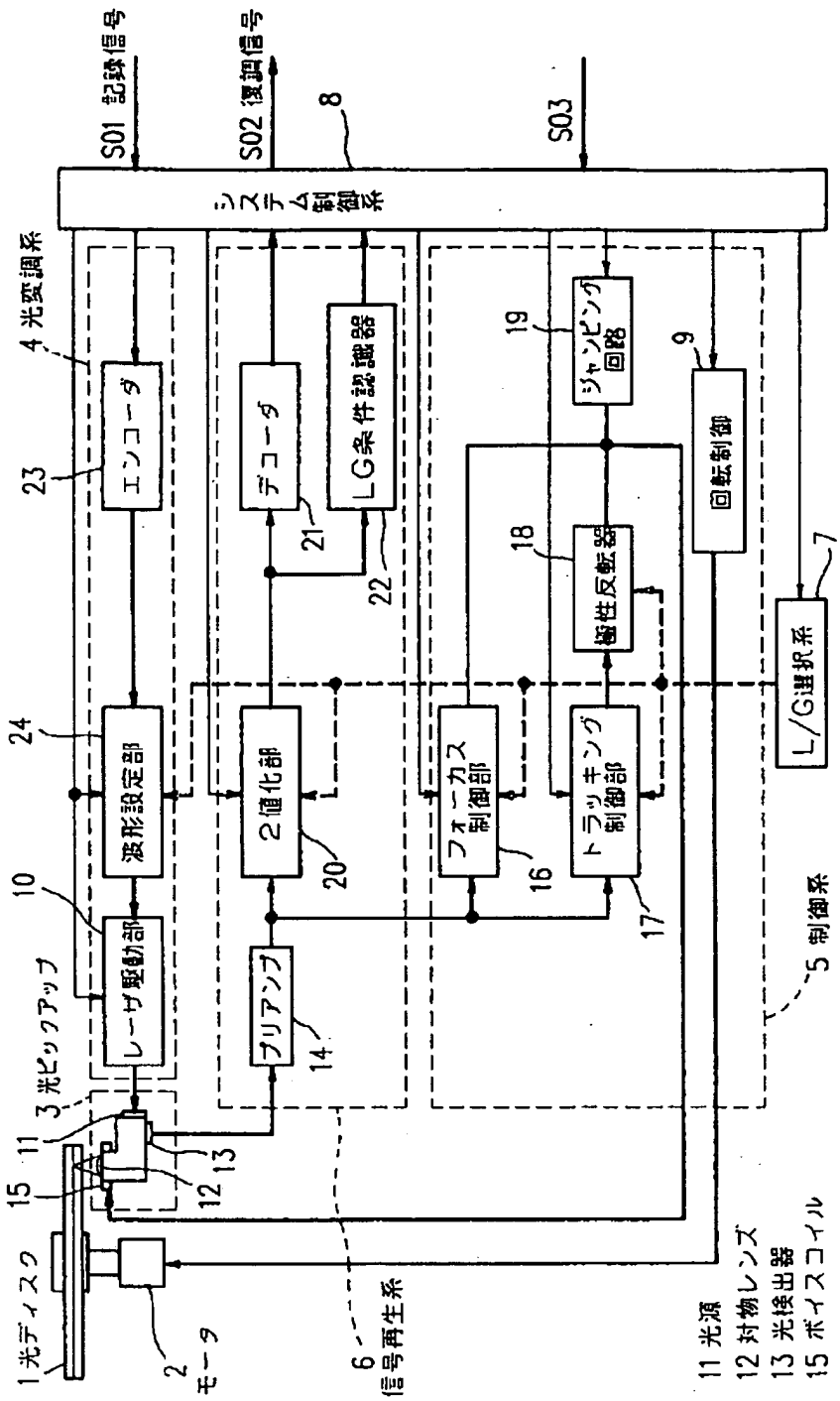
[Drawing 3]



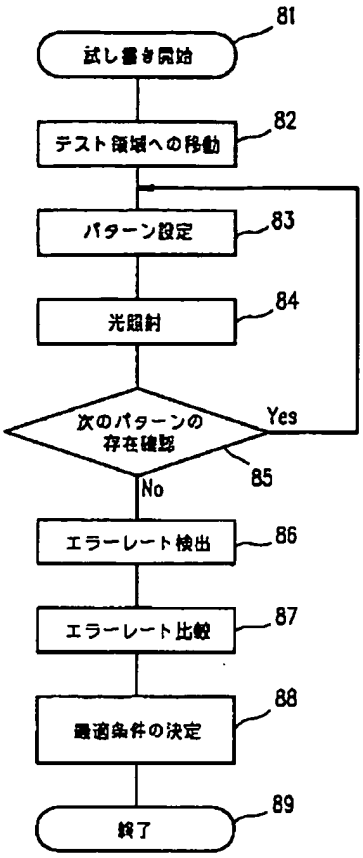
[Drawing 5]



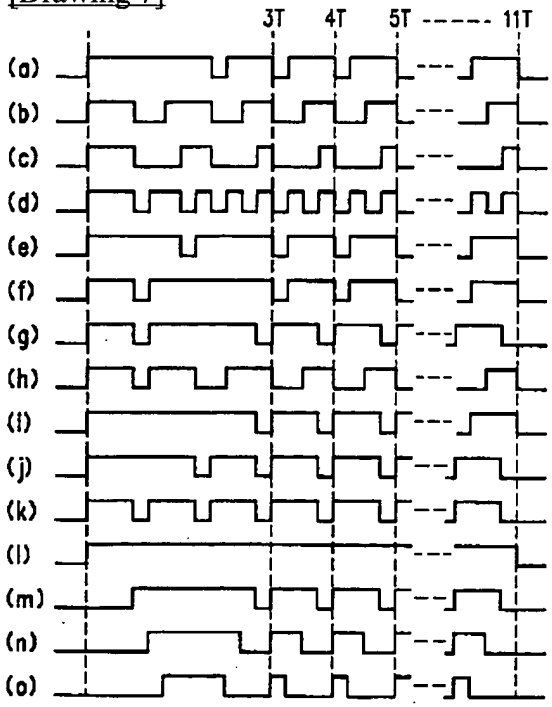
[Drawing 1]


S01 記録信号
S02 復調信号
S03
8
システム制御系
4 光変調系
エンコーダ
デコーダ
LG条件認識器
ジャンピング回路
19
9
回転制御
23
21
22
18
極性反転器
7
L/G選択系
24
波形設定部
2値化部
フォーカス制御部
トラッキング制御部
10
レーザ駆動部
プリアンプ
20
16
17
5 制御系
3 光ピックアップ
11
13
12
15
1 光ディスク
2 モータ
6 信号再生系
11 光源
12 対物レンズ
13 光検出器
15 ボイスコイル

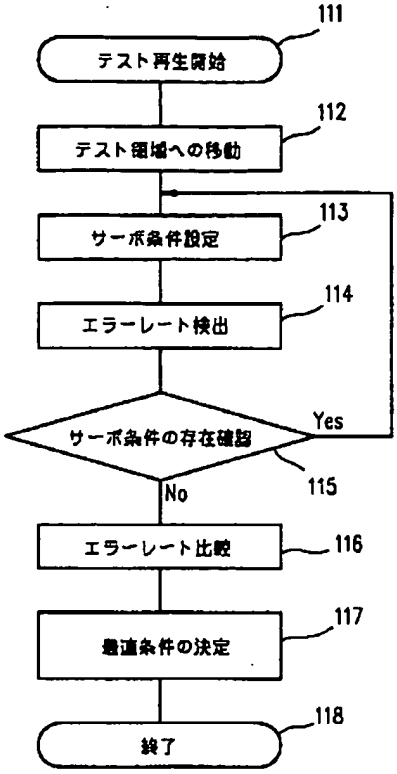
[Drawing 8]



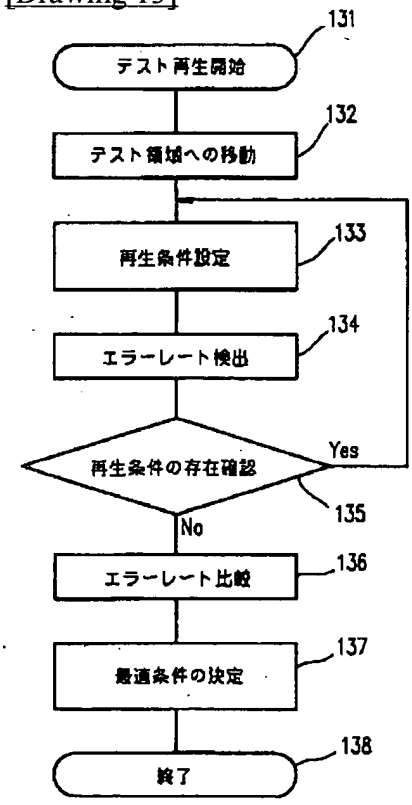
[Drawing 7]



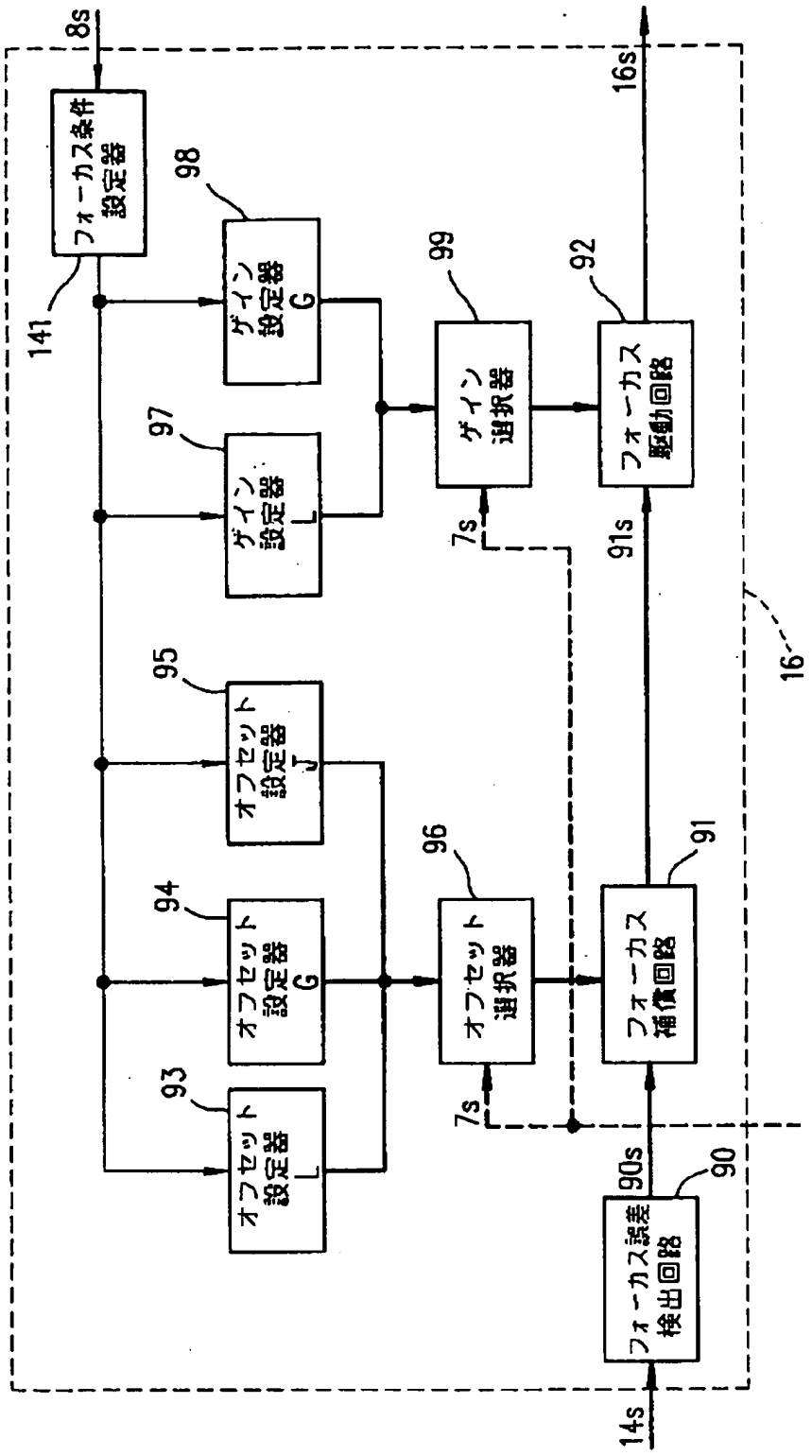
[Drawing 11]



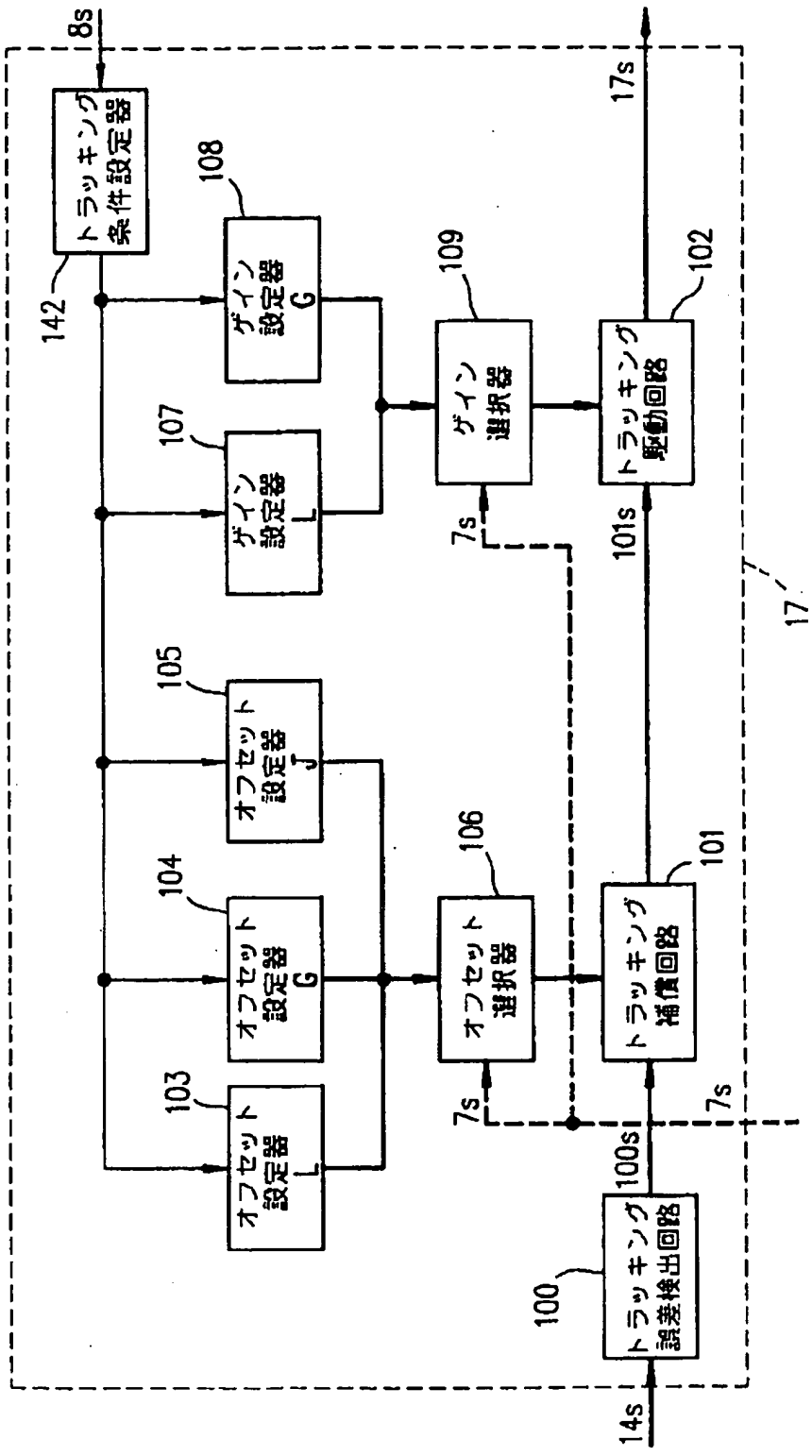
[Drawing 13]



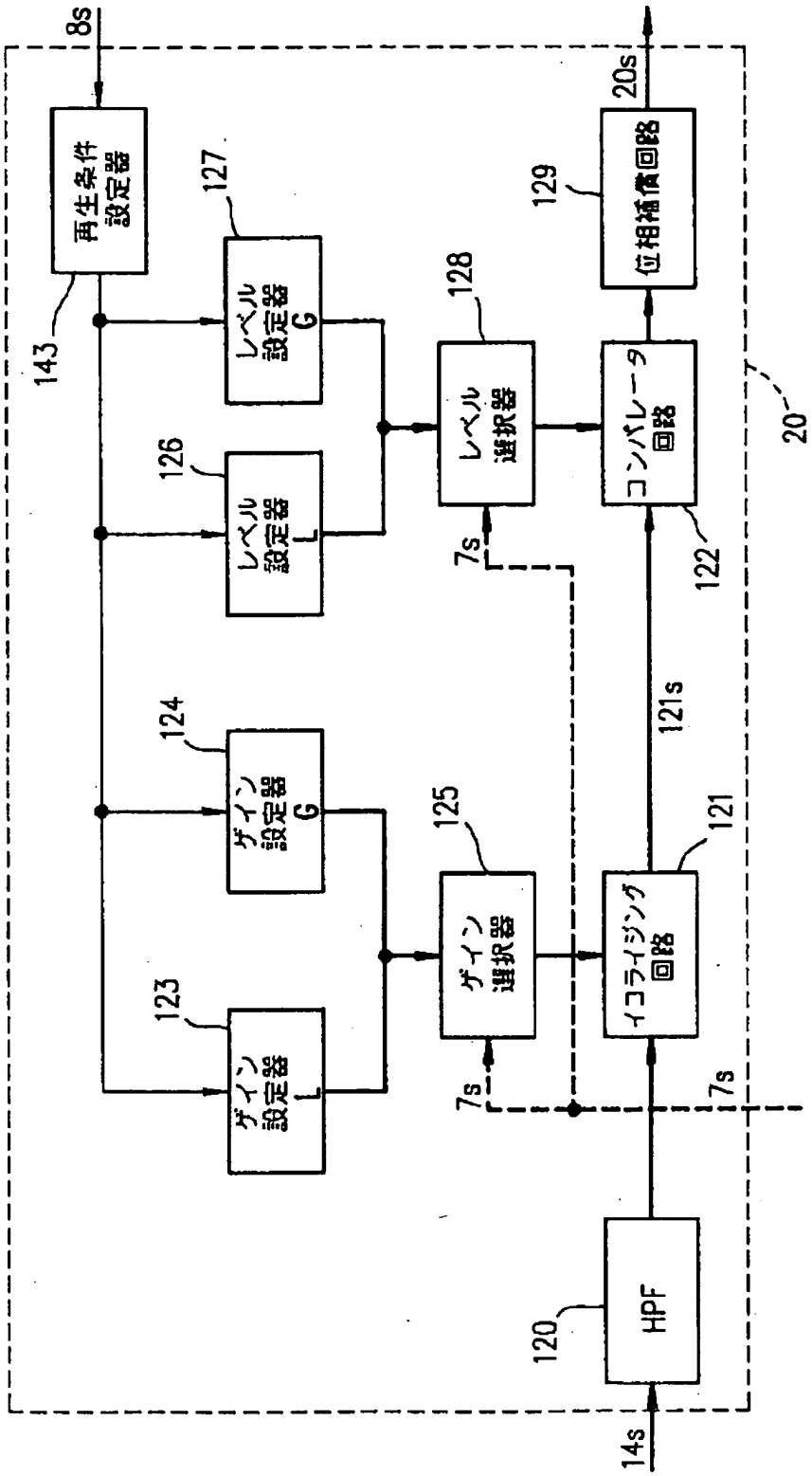
[Drawing 9]


8s
フォーカス条件設定器
141
98
ゲイン設定器 G
97
ゲイン設定器 L
99
ゲイン選択器
92
フォーカス駆動回路
16s
7s
91s
16
95
オフセット設定器 J
94
オフセット設定器 G
93
オフセット設定器 L
96
オフセット選択器
91
フォーカス補償回路
7s
90s
90
フォーカス誤差検出回路
14s

[Drawing 10]


8s
トラッキング条件設定器
142
108
ゲイン設定器 G
107
ゲイン設定器 L
109
ゲイン選択器
7s
17s
102
トラッキング駆動回路
101s
17
105
オフセット設定器 J
104
オフセット設定器 G
103
オフセット設定器 L
106
オフセット選択器
7s
101
トラッキング補償回路
7s
100s
100
トラッキング誤差検出回路
14s

[Drawing 12]



[Translation done.]